

What is claimed is:

1. An electrolyte membrane comprising a porous substrate that does not swell substantially with methanol and water, wherein pores of the porous substrate are filled with polymer having proton conductivity.
2. The electrolyte membrane according to claim 1, wherein the porous substrate is comprised of inorganic material or heat-resistant polymer.
3. The electrolyte membrane according to claim 1 or 2, wherein the polymer having proton conductivity is graft polymer.
4. The electrolyte membrane according to claim 2 or 3, wherein the inorganic material is one selected from the group consisting of ceramic, glass and alumina, and composite materials thereof.
5. The electrolyte membrane according to claim 2 or 3, wherein the heat-resistant polymer is polytetrafluoroethylene or polyimide.
6. A method for manufacturing an electrolyte membrane comprising the steps of: irradiating a porous substrate that is swelling-resistant against organic solvent and water with energy; and then contacting monomers with the substrate to be allowed to react polymerization.
7. A fuel cell comprising the electrolyte membrane according to any one of claims 1 to 5, wherein the electrolyte membrane is formed on a cathode or on a catalyst layer formed on the cathode.
8. A fuel cell comprising a cathode, an anode, and an electrolyte sandwiched therebetween, wherein the electrolyte comprises a porous substrate and a polymer having proton conductivity, and wherein the porous substrate does not swell substantially with methanol and water, and the polymer is filled in pores in the porous substrate.
9. The fuel cell according to claim 8, wherein the fuel cell is a direct methanol polymer fuel cell.
10. A method for manufacturing a fuel cell comprising the steps of: applying sol to a first electrode; forming a porous thin layer from the applied sol; filling polymer in pores of the porous thin layer to form an electrolyte membrane on the first

electrode; and attaching a second electrode onto the electrolyte membrane.

11. The method according to claim 10, wherein, the polymer is graft-polymerized so that one end of the polymer is bound to the surface of the pores, to fill the pores with the polymer in the step of forming the electrolyte membrane.
12. The method according to claim 10 or 11, wherein the first electrode has a first support layer and a first catalyst layer, and wherein the sol is applied to the catalyst layer in the step of applying sol.
13. The method according to any one of claims 10 to 12, wherein the second electrode has a second support layer and a second catalyst layer, and wherein the electrolyte membrane is attached to the second catalyst layer in the step of attaching the second electrode.

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